

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

No. 63. MARCH 1863.

XVIII.—*Observations on the British Tunicata, with Descriptions of several new Species.* By JOSHUA ALDER.

[Plate VII.]

ALTHOUGH much has been done towards the investigation of our marine zoology of late years, few British naturalists have paid any attention to the Tunicata. The unattractive appearance of many of the species, and the difficulty of finding characters to distinguish them, have probably deterred zoologists from undertaking the task. The first objection undoubtedly holds good with respect to most of the simple Ascidiæ; but many of the compound species are eminently beautiful and attractive, though the difficulty of discriminating these is even greater than in the more simple forms. Whatever be the cause, it is certain that the study of the British Ascidiæ has been very much neglected. The interesting account of this class given by Professor Edward Forbes in the 'History of British Mollusca' is, however, an exception to the general neglect; and had that distinguished naturalist lived to fulfil his intention of writing, in conjunction with Prof. Goodsir, a monograph of the British Tunicata, such a work would undoubtedly have left little further to desire. The lamented death of Prof. Forbes has, however, prevented this project being carried out.

For several years I have incidentally paid a little attention to this tribe, and, having lately had occasion to investigate the subject more closely, I purpose in the present communication to describe such new species as have come under my notice since the publication of the 'British Mollusca,' as well as to illustrate some obscure forms that have previously been imperfectly understood.

Ascidia pustulosa, n. sp.

Body ovate, rugose, horn-coloured, adhering towards the base. *Apertures* sessile, strongly tuberculated or echinated, reddish; the anal one terminal, the branchial nearly one-third down the side. *Test* rather thick, semitransparent, coriaceous, covered with irregular-sized warty or pustulose tubercles, principally on the upper or left side*; these generally bear smaller tubercles or echinations on their surface: the lower or recumbent side is nearly smooth. *Mantle* yellowish, blotched with red, especially towards the apertures, and sprinkled with opaque white. *Tentacular filaments* few and stout. *Branchial sac* with rather small papillæ: ventral plait smooth. Length about 3 inches.

I dredged a single specimen of this new species in Fowey Harbour, Cornwall, in the summer of 1847; and two specimens, now in the Edinburgh Museum, were got in Lamlash Bay by Prof. Allman. It is readily distinguished from *A. mentula* by its pustulose tubercles, as well as by its more ovate form.

Ascidia obliqua, n. sp.

Body transversely ovate, light horn-coloured?, rather rugose when old, but not tuberculated, nearly smooth when young; attached diagonally at the base and partially at the side, leaning over towards the dorsal aspect. *Apertures* not far apart, conical, with longitudinal grooves corresponding to the angles of the lobes; the branchial aperture not quite terminal, the anal median: ocelli inconspicuous. *Test* rather thin, transparent, sometimes a good deal covered with zoophytes. *Tentacular filaments* slender. *Branchial sac* with large subclavate papillæ: ventral plait transversely ribbed. Length about two inches.

Three examples of this Ascidian in different stages of growth were dredged by my friend the Rev. A. M. Norman in 40 to 50 fathoms water, off the Outer Haaf, Shetland. The largest of these measured a little above two inches. A somewhat larger specimen was sent to me from Sweden by Prof. Lovén, with the name of *Ascidia mentula* attached. It has probably hitherto been overlooked as a variety of that species, but it is perfectly distinct: the form is more ovate, the transverse diameter being generally

* Some difference of opinion exists with regard to the positions of the organs in the Ascidians. I here follow the view adopted by Savigny, Huxley, and others, who consider the side on which the anal aperture is situated to be ventral, and the opposite side dorsal. The right side, on this view, is that on which the viscera are placed. In the *Ascidia* proper the animal always adheres more or less by the right side, thus affording protection to these organs. M. Milne-Edwards considers the vent to be placed on the dorsal aspect: the names of right and left side are consequently, in his nomenclature, reversed.

a little the broader; the test is very much thinner, and attached obliquely at the base; the apertures are more distinctly grooved and less distant; and the branchial sac has not the intermediate papillæ, nor is it reflected upwards as in *A. mentula*. It appears to be a northern species.

The longitudinal strands of the branchial meshes in this species are very tender, and are often found broken in spirit specimens, and contracted towards the papillæ, giving the latter the appearance of being tricuspidate.

Ascidia rudis, n. sp.

Body oblong or ovate, rather irregular, depressed, greenish, attached largely by the side. *Apertures* distant, the branchial terminal, the anal generally about halfway down: ocelli red, reniform. *Test* thick, coriaceous, coarse, wrinkled, and very slightly tuberculated, sometimes nearly smooth. *Mantle* bluish-green, with a yellowish tinge towards the upper part; the apertures distinctly tubular; the anal tube often much extended, and entering into a sheath in the substance of the test. *Tentacular filaments* few and slender. *Branchial sac* green, with stout papillæ at the intersections of the meshes, and frequently with intermediate ones on the longitudinal strands: ventral plait transversely ribbed. Length about $2\frac{1}{2}$ inches.

Several specimens were obtained by Mr. Norman, at low-water mark, near the Whalsey Lighthouse, Outer Skerries, Shetland, in company with a large variety of *A. depressa*, to which externally it bears some resemblance; but it has a much closer affinity with *A. mentula*, and has probably hitherto been taken for a variety of that species. There are, however, sufficient grounds to consider it distinct. *A. rudis* never reaches the size of *A. mentula*, and is of a different colour; it is much more largely attached, and bears small, distant tubercles. The tubular form of the anal orifice in the mantle, too, is characteristic, though this is not conspicuous outside, the tube being imbedded in the thickening of the test, and the external aperture varying in position in proportion to its length. In a variety from Hastings, which I owe to the kindness of Mrs. Blackett, the tube is very much elongated within the test, and opens at a very short distance from the branchial aperture. Usually, however, it is situated about halfway down, pretty near to the position it occupies in the mantle.

Ascidia plebeia, n. sp.

Body oblong, slightly scabrous, attached for nearly its whole length, greenish. *Branchial aperture* terminal, produced, conical; *anal aperture* about two-thirds down, slightly raised: ocelli small,

red. *Test* thin, transparent, roughish with small papillæ, and slightly covered with fragments of shell and sand, especially towards the attached part. *Mantle* yellowish green. *Tentacular filaments* numerous and stout. *Branchial sac* with papillæ at the intersections of the meshes, and occasional small intermediate ones on the longitudinal strands: ventral plait plicated. Length about two inches.

Examples of this species were dredged on the Outer Haaf, Shetland, by the Rev. A. M. Norman and J. Gwyn Jeffreys, Esq. I have also met with one or two *Ascidia* from the coasts of Northumberland and Durham, which I am inclined to refer to the same. It has affinities with *A. aculeata* and *A. depressa*. From the first it may be known by its more elongated form, its more prominent apertures, and by the papillæ of the test being smaller, fewer, and not echinated; from the latter by its thinner test and less area of attachment, as well as by the absence of the thickened margin or disk that divides the upper from the under surface in that species; from both it may be distinguished by the fragments of shells with which it is more or less covered.

Ascidia aculeata, n. sp.

Body ovate, depressed, greenish, more or less attached by the side to sea-weeds or zoophytes. *Apertures* nearly sessile, aculeated, the branchial terminal, the anal about one-third down the side. *Test* thin, transparent, greenish or nearly colourless, covered with aculeated tubercles most prominent on the upper or left side. *Mantle* greenish, transparent, showing the reticulations of the branchial sac and sigmoid intestine. *Tentacular filaments* small. *Branchial sac* with moderate-sized papillæ at the intersections; the stomata elliptical: ventral plait smooth. Length an inch to an inch and a half.

I first met with this species, many years ago, in Torbay. It has since been found at Bantry Bay and Guernsey, by Mr. Norman, and by Dr. W. B. Carpenter in Lamlash Bay, Arran. It is usually attached to sea-weeds, and appears to inhabit shallow water.

This species comes nearest to *A. depressa*, but is less depressed, less largely attached, and without the marginal disk dividing the upper from the under surface; the test is more uniformly thin, and has stronger and more sharply pointed tubercles. The apertures are also less distant. The tubercles are frequently compound, bearing several aculeations. This is probably the "*Ascidia mammillaris*, Delle Chiaje" of Thompson's 'Natural History of Ireland,' but, I think, not of Delle Chiaje, judging from his figure.

Ascidia pulchella, n. sp.

Body elongate, cylindrical, reddish, pale yellow or hyaline white, attached by a rounded base, and capable of great retraction. Apertures tubular, terminal; the *branchial* much the longer, nearly one-third the length of the body, and continuous in outline with it; the *anal aperture* about half as long as the branchial, and a little narrower, projecting diagonally; both orifices with bright crimson ocelli. A deeply impressed line runs from between the terminal tubes to nearly the base of the body. Test soft, smooth, hyaline, and transparent. Mantle yellowish, passing to red above, or sometimes colourless, with longitudinal muscular bands, narrower than in *A. intestinalis*. Tentacular filaments stout. Branchial sac with rather broad papillæ: ventral line with long filaments. Length an inch, or a little upwards.

Procured at Fowey Harbour by Mr. Peach, from whom I have drawings. The Rev. T. Hincks has also obtained it in Salcombe Estuary, and has favoured me with his manuscript notes and a pencil sketch. The description of the internal parts is taken from specimens dredged by the Rev. A. M. Norman in Guernsey.

This pretty *Ascidia* belongs to the section of the genus which Savigny has called "*Phallusiæ Cionæ*," and which constitute the genus *Cionæ* of Fleming. They are distinguished by having the viscera extended below the branchial sac, and by the softness and flexibility of the test, the upper part of which can be withdrawn within the lower, concealing the orifices. This species comes very near to *A. intestinalis*, but may be distinguished from it by its smaller size and its much more elongated and unequal tubular orifices, as well as by the colour, which is never tinged with green as in that species, but is generally more or less marked with red, though it is occasionally colourless. The longitudinal bands of the mantle are much narrower than in *A. intestinalis*. The figure given in Blainville's 'Malacologie' under the latter name seems to be taken from an individual of this species.

Ascidia parallelogramma, Müller.

This lovely *Ascidian* is distinguished from all its congeners by several interesting characters which may perhaps be considered sufficient to raise it to the rank of a separate genus. It agrees with the genus *Ascidia*, as at present characterized, in having the apertures divided into the same number of segments (8 and 6), in having the test united to the mantle at the orifices only, and in having the branchial sac with papillæ and without folds. All the true *Ascidie* with which we are acquainted, however, are attached more or less by the right side, on which are

placed the viscera; the smaller branchial meshes, moreover, are rectilinear. In the present species the animal is attached by the base, near which the viscera are placed, but on the left side. There is another peculiarity attending this species, namely, that the flexure of the intestine is in a contrary direction to what is usual in the genus. The intestine, after leaving the stomach, usually rises *upwards* on the right side of the branchial sac, and, afterwards bending downwards, forms a sigmoid curve, rising again towards the anal orifice. In this species the intestine, after leaving the stomach, bends immediately *downwards* on the left side, and, running along the base, rises towards the anal orifice*. It will be seen from these details that *A. parallelogramma* is a true sinistral species. But the chief peculiarity of this interesting Ascidian is in the meshes of the branchial sac, which are beautifully convoluted in a spiral direction on a flat surface (Pl. VII. figs. 1 & 2). From the centre of each spiral, smaller bands radiate to the circumference, which serve to hold the spiral vessels in their places. This delicate and complicated system of vessels is traversed by larger longitudinal vessels, which are on a different plane, and internal in position to the other portions of the sac, to which they are united by broad transverse vessels, that rise to them in a kind of loop, the apex of which forms the papilla. The spiral vessels are thus set in a square frame, the only part that is visible until a high magnifier is applied. This is perhaps the reason why this beautiful structure has hitherto escaped observation, as the species is pretty generally diffused, and from its beauty usually attracts attention. This species also differs from the other *Ascidia* in having the anal tube much the longer—a character only to be observed in the living animal. A variety of it is the *Ascidia virginea* of Forbes, but not of Müller.

The *Phallusia Turcica* of Savigny is a sinistral species, having a flexure of the intestine in the same direction as this; but the branchial sac, though peculiar, has the meshes rectilinear, and not convoluted.

Genus MOLGULA, Forbes.

The *Molgula* of Forbes was founded on external characters only, the principal one being the number of segments in the apertures—a character which has been taken by common consent for generic distinction in this tribe, and, though of little physiological importance, generally carries with it others of greater functional value, so that the genera founded upon it have usually been found to be natural. This has fortunately been the case with the present genus, the internal characters

* Both flexures are dorsal, but in different directions.

fully bearing out the propriety of its separation from the allied genera *Ascidia* and *Cynthia*, between which it is somewhat intermediate, and though more nearly allied to the latter, yet at the same time possessing characters distinct from both. Where external characters can be found to distinguish genera and species, it is always desirable that they should be adopted in description, though, of course, the whole structure of the animal must be studied in order to assign it its proper place in a natural arrangement. To any one conversant with the *Tunicata*, it must be obvious that external characters are often insufficient to determine the species, or sometimes even the genus, of many of the simple *Ascidians*. Internal characters must therefore be resorted to; and of these the structure of the branchial sac and the tentacular filaments are not only of most importance, but of most easy access for examination. The branchial sac of *Molgula* is very peculiar, the meshes being convoluted in an irregular manner, differing from any other with which I am acquainted. I propose, therefore, to re-define *Molgula* in the following manner:

Animal generally free, or only slightly attached by glandular hairs. *Test* thin and membranous, often covered with sand or fragments of shells, very slightly attached to the mantle except at the two apertures. *Branchial aperture* 6-lobed, anal 4-lobed; ocelli inconspicuous or none. *Tentacular filaments* branched. *Branchial sac* with longitudinal folds; the meshes more or less convoluted, without papillæ. *Ovaries* on both sides of the body, that on the right situated outside the flexure of the intestine. Stomach and intestine lateral and dextral, the latter bending upwards as in *Ascidia*, but with the flexure more compressed.

Molgula socialis, n. sp.

Body ovate, covered with fine sand, adhering by a small base. *Apertures* terminal, approximated, rather small, tubercular. *Test* greenish, thin, soft, covered with longish, unbranched, rather rugged, glandular hairs. *Mantle* greenish, soft. *Tentacular filaments* large, much branched, tripinnate. *Branchial sac* with six folds on each side, the meshes irregular and imperfectly convoluted. Height about half an inch. Densely gregarious.

For a knowledge of this species I am indebted to Dr. Bowerbank, who obtained it from the fishermen at Hastings. The specimens were attached to *Pecten maximus*, from the Diamond trawling-ground, about twelve miles from that place.

Unlike the other species of this genus, which are generally solitary, this *Molgula* is associated in dense masses, firmly adhering to each other, and so closely as often to press the sides into a square or hexagonal form. The tentacular filaments are large in proportion to the animal, and beautifully arborescent.

I am now acquainted with seven British species of this genus, including the *Ascidia conchilega* of Müller (which is a *Molgula*) and the following species, whose internal characters, however, show a considerable departure from the type of the genus.

Molgula arenosa, Alder & Hancock.

Body globular, hyaline, unattached, closely covered with sand, excepting generally a bright smooth area on one side. *Apertures* nearly terminal, approximated, not much produced, conical or slightly tubular, retractile, set in a small circumscribed area with a raised rim, appearing like a slit when contracted. *Test* soft, glossy, transparent, and colourless, with delicate slender hairs, sometimes a little branched. *Mantle* very thin, soft, and transparent, showing the viscera very distinctly through. *Tentacular filaments* bipinnate, beautifully spotted with bright opaque yellow. *Branchial sac* with six longitudinal bands on each side, between which are six rows of conical eminences formed of a double spiral coil of delicate vessels meeting at the apex, and giving the sac a festooned appearance (Pl. VII. figs. 3 & 4). There are also transverse bands. *Ovaries* double, that on the right side lying within the loop of the intestine. Diameter half to three-quarters of an inch.

This species was described in the Transactions of the Tyneside Naturalists' Club (vol. i. p. 197), and is also the *Molgula tubulosa* of Forbes in the 'British Mollusca,' who referred it (we think erroneously) to the *Ascidia tubularis* of Rathke in 'Zoologia Danica.' It is probable, however, that he may have included more than one species under this name, as there are several sand-coloured Ascidiæ that are with difficulty distinguished on a superficial examination. His description belongs to *M. arenosa*, but the figure represents the tubes much longer and more cylindrical than the usual form.

Externally *M. arenosa* does not materially differ from the other *Molgulæ*, and it has the apertures divided into the same number of segments; but the branchial sac presents very marked characters in the beautiful spiral cones of which it is composed, and in the absence of regular folds. Besides the spiral vessels of the cones, others, less conspicuous, but of equal, if not greater width, pass downwards from the apex to the circumference. The whole structure is extremely delicate, and its fragility renders it difficult to preserve it entire for examination. A further difference between this and the other *Molgulæ* is observable in the position of the right ovary, which is situated within, and not outside, the intestinal loop.

The *Cynthia Dione* of Savigny has a branchial sac of a structure apparently similar to this, and, were it not for its four-cleft

apertures fringed with small filaments, might have belonged to the same genus. The right ovary in that species is placed outside the intestinal flexure.

Ascidia parallelogramma on the one hand and *Molgula arenosa* on the other, form two links in the chain of affinities uniting *Ascidia* and *Cynthia*, while each at the same time possesses characters peculiar to itself.

Genus CYNTHIA, Savigny.

Savigny has divided *Cynthia* into four sections, which he names *Cynthiae simplices*, *C. Cæsiræ*, *C. Styelæ*, and *C. Pandociæ*. The first and third of these only are represented in the British fauna, unless the second (containing one species only, *C. Dione*) may be considered congeneric with the *Molgula arenosa* already described. The fourth section* agrees in all respects with the third, excepting in the position of the ovary, which is confined to the right side of the body. The genus *Dendrodoa* of M'Leay also possesses similar characters, but with ovaries on the left side only. The form and position of the ovaries are very variable in the genus *Cynthia*, and, though affording good specific distinctions, can scarcely be considered of generic value.

Cynthia squamulosa, n. sp.

Body ovate or subglobose, of a pinkish hue, tinged with lilac, attached by a broad base. *Apertures* a little apart, rather large and conical, but not much produced; the branchial one terminal, the anal nearly so; each margined and rayed with violet. *Test* tough, smooth or slightly mammillated, covered with small scaly plates marked with concentric lines. *Tentacular filaments* slender, simply pinnate. *Branchial sac* with six folds on each side. *Ovaries* forming a double, linear, perpendicular series on each side, with a fimbriated mass of sperm-cells (?) between. Diameter about half an inch.

This species, which I first met with in Guernsey, in 1853, where several specimens occurred on oysters dredged in about fifteen fathoms, has since been sent me from Lulworth Cove by my friend Mr. J. Gwyn Jeffreys. It appears to be a southern form.

Cynthia rosea, n. sp.

Body cylindrical, short, nearly as broad as high, adhering to shells by a tolerably broad base. *Apertures* on large mammillæ, yellowish, with four double stripes of red, and covered with mi-

* The *Pandocia conchilega* of Dr. Fleming (Brit. Anim. p. 468), the generic character of which appears to be taken from this section of Savigny's *Cynthia*, is probably referred to it by some mistake.

nute, crystalline, pointed spicula. *Test* thick, tough, opaque, smooth, rose-coloured, closely adhering to the mantle. *Mantle* flesh-coloured, opaque. *Tentacular filaments* large, bipinnate. *Branchial sac* with seven deep folds on each side; ventral plait smooth, undulated above. Length about half an inch.

A single specimen of this beautiful *Cynthia* was procured by Dr. Bowerbank from the Diamond trawling-ground near Hastings. In some of its characters it approaches the *C. microcosmus* of Savigny, which Prof. Milne-Edwards informs me is distinct from the *C. microcosmus* of Cuvier; but its smooth test, without corrugations, and the absence of any parasitic growth over the surface, forbid our referring it to that species. The small crystalline spicula surrounding the apertures are very curious and peculiar.

Cynthia echinata, Müller.

Prof. E. Forbes has referred this species by mistake to *Ascidia*, and the apertures in his figure (Brit. Moll. vol. i. pl. c. fig. 4) are erroneously represented with six and eight lobes. They are both decidedly quadrate. The branchial sac has six folds on each side, and the smaller meshes have the peculiarity of being transverse instead of longitudinal as in the other species. The tentacular filaments are branched.

Cynthia mammillaris, Pallas.

The *Ascidia mammillaris* of Pallas does not appear to have been recognized by later naturalists. A *Cynthia* sent me by Mr. Spence Bate from Plymouth, by Mr. Jeffreys from Lulworth Cove, and by Dr. Bowerbank from Hastings, must, I think, be referred to this species, found "on submarine rocks in Cornwall" by Gærtner nearly a hundred years ago. It is very irregular in form, generally transversely ovate, deeply wrinkled, and strongly lobated. The test is tough, thick, and of a dirty yellowish colour, generally covered with small Zoophytes and other parasites, and with stones and fragments of shells adhering near the base. The apertures are not far apart, and rayed with red internally: the tentacular filaments are linear; and the branchial sac has four folds on each side. It therefore belongs, like the majority of our British species, to the third section of Savigny. It appears to be not uncommon on the south coast of England, and may perhaps be the species alluded to by Forbes under the head of *C. microcosmus*, to which in external appearance it bears some resemblance.

Cynthia sulcatula, n. sp.

Body subcylindrical when extended, hemispherical when contracted, attached by a broad base. *Apertures* terminal, on long

tubes (about one-third the length of the body), approximated at the base, and nearly disappearing on contraction; they are margined with a red line, or entirely crimson. *Test* dark reddish brown, rough with longitudinal and transverse furrows, giving the surface a beaded appearance. *Mantle* bright crimson or scarlet. *Tentacular filaments* linear. *Branchial sac* with four folds on each side. *Ovaries* scarlet, disposed in spherical masses over the inner surface of the mantle. Length half to three-quarters of an inch.

This species is found on *C. tuberosa*, and on the roots of *Laminariae* at Cullercoats. Mr. George Hodge has also sent it me from Seaham Harbour.

The approximated tubular apertures, regularly furrowed surface, and great contractility distinguish this species from the young of *C. tuberosa*; the character of the surface likewise distinguishes it from *C. coriacea* and *C. granulata*, to which it is more nearly allied. In a contracted state, the test becomes much corrugated, and the apertures then appear large and four-cleft.

Cynthia granulata, n. sp.

Body cylindrical when extended, nearly hemispherical when contracted, reddish, adhering at the base. *Apertures* terminal, slightly tubular, approximated; reddish, with a dark red line round the margin. *Test* tough, finely shagreened or granulated, but appearing nearly smooth to the naked eye, yellowish or brownish red. *Mantle* crimson above, passing to orange or yellow below. *Tentacular filaments* linear. *Branchial sac* with four folds on each side. Length about half an inch.

This species appears to be pretty widely distributed on the British coast. I have met with it on shells or on other *Ascidiae*, from moderately deep water, on the coasts of Northumberland and Durham, as well as at Guernsey and the Isle of Man. Mr. Jeffreys has also got it at Lulworth Cove.

This *Cynthia* somewhat resembles the last, and is occasionally associated with it on the test of *C. tuberosa*. It may, however, be at once distinguished by the shagreening of the test, which is best seen when the surface is dry, it then appearing covered with minute shining facets. *C. granulata* may also be distinguished from *C. sulcatula* by its shorter tubes and smaller apertures.

Cynthia comata, Alder.

Cynthia ampulla, Forbes & Hanl. Brit. Moll. vol. i. p. 40; Alder & Hanc. in Tynes. Club Trans. vol. i. p. 197.

A more careful examination of this species, and a comparison of it with the original description and figure of Baster, convince

me that it has been erroneously referred to his *Ascidium* (the *Ascidia ampulla* of Bruguière). That species is described to be thickly covered with minute hairs hooked at the points, and has the tubes granulated or shagreened, in neither of which characters does the present species agree with it: nor does Baster's *Ascidium* appear to be coated with sand—a character so remarkable in *C. comata*, from the depth to which it is generally covered. This arises from the great length of the glandular hairs, and is especially the case in old individuals, where the hairs are much branched and become thickened at the base, giving the test a peculiar appearance when the sand is removed.

This and the following species belong to the *Glandula* of Stimpson*, a genus separated from *Cynthia* on account of the individuals being unattached. As this character, however, is not corroborated by any structural difference, and is also found in some species of other genera, we have not thought it desirable to give it generic rank.

Cynthia glacialis, Sars.

Body orbicular or ovate, a little compressed, unattached, and entirely covered with sand and fragments of shells. *Apertures* approximated and slightly tubular when expanded, inconspicuous when withdrawn, of a dull, semitransparent white. *Test* smooth, whitish, soft and rather thin, a little wrinkled towards the apertures, apparently without hairs, the shelly fragments adhering directly to the skin. *Mantle* transparent and nearly colourless. *Tentacular filaments* simple, linear. *Branchial sac* with four folds on each side. *Ovaries* in parallel cylindrical masses, extending transversely, about four on each side. Diameter rather more than half an inch.

Two specimens were obtained from the fishing-boats at Craster, Northumberland, by Mr. J. Stanger, in 1860; and it has since been dredged on the northern part of the same coast.

Believing this species to be undescribed, I had proposed for it the name of *C. vestita*, under which appellation its discovery was announced by Mr. Stanger in the 'Transactions of the Tyneside Naturalists' Field Club' (vol. iv. p. 335). I have since found that Prof. Sars had previously met with it on the coast of Norway, and had published a notice of it under the name of *Glandula glacialis* (Forhandl. i Vidensk. Selsk. i Christiania for 1858).

Cynthia opalina, n. sp.

Body transversely ovate, strongly but irregularly mammillated, opaline white, attached by a broad base. *Apertures* not far apart, rather large; the branchial one placed not far from the

* Proceedings of the Boston Society of Natural History for June 1852.

anterior end. *Test* thick, smooth, white, semitransparent, adhering strongly to the mantle throughout. *Mantle* opaque white, with one or two blotches of red near the apertures. *Tentacular filaments* linear (?). *Branchial sac* with four folds on each side (?); ventral line smooth, inconspicuous. Breadth three-quarters of an inch; height one-third less, rising a little towards the anterior end.

A single specimen of this pretty species was obtained by Dr. Bowerbank from the Diamond fishing-ground, near Hastings. As the internal parts were partially decomposed, their character could not be very satisfactorily made out. We know of no other *Cynthia*, however, with which it can be confounded. In its opaline and mammillated test it somewhat resembles a miniature *Ascidia mammillata*; but, besides its generic difference, it likewise differs in form, and in the more numerous and smaller mammillæ.

Cynthia violacea, n. sp.

Body very much depressed or nearly flat, transversely ovate or rounded in outline, and adhering by a broad expanded base. *Test* slightly hispid, and completely covered with small grains of sand. *Apertures* on rather long and slender tubes of a violet colour, set very little apart, and nearly equally distant from both ends. Diameter a quarter of an inch.

Two specimens occurred to me on an old shell of *Pecten maximus* among the rocks on Mrs. Hughes's Island, Menai Straits, in 1852.

Although, from its minuteness and delicacy, the internal parts of this species could not be examined, there can be little doubt of its distinctness from any other described *Cynthia*. The grains of sand adhere so closely that they can scarcely be removed without tearing the test, which is very thin.

Cynthia grossularia, Van Beneden.

The *Ascidia rustica* figured and described by Müller in 'Zoologia Danica' contains two, if not three species, supposed by him to be different stages of growth of one and the same animal. Continental authors have (and, I think, rightly) considered the largest or adult form to be the *Ascidia rustica* of Linnæus, agreeing with his description "*corpus oblongum, subcylindricum, brunneum.*" The supposed youngest form of Müller is undoubtedly distinct, and is the species which English authors have hitherto called *Cynthia rustica*. Having ascertained, however, from specimens sent me by the accomplished author, that Prof. Van Beneden's *Cynthia grossularia* is identical with our

British form, I do not hesitate to adopt his name. It appears also to be the *Cynthia gutta* of Stimpson. The true *Ascidia rustica* has not yet been met with in this country; but I have lately found, in the collection of the late Mr. Wm. Thompson, of Belfast, a *Cynthia* from Killery Bay, on the west coast of Ireland, which appears to be the second form figured by Müller, and which is probably also distinct from the *C. rustica*. It is nearly spherical, with a thin delicately wrinkled test, and is about three-quarters of an inch in diameter.

Cynthia grossularia is an extremely variable species, changing its appearance so much in different situations and under different circumstances, that we have sometimes been induced to think that more than one species might be included in it. When growing singly, it is rather depressed, and the test spreads into a thin membrane round the base; but, in sheltered situations, as under shelving rocks, the individuals accumulate in compact masses, so closely packed as to allow of growth only upwards, and adhering very firmly to each other at the sides. The young in such cases often attach themselves to the surface of the parent, so as, at first sight, to appear as if budding from it. In the more free state, likewise, the spreading bases of several individuals sometimes come into contact and unite; but, on careful inspection, the line of union can generally be detected. The test, viewed as a transparent object under the microscope, always shows transverse anastomosing corrugations; but it often appears smooth to the naked eye, especially in the young state.

Cynthia glomerata, n. sp.

Body ovate or subglobose, smooth, cherry-red, the individuals crowded into closely adherent clusters. *Apertures* rather small, not far apart, very slightly prominent, quadrate, but sometimes appearing as a simple slit when closed. *Test* tough, rather shining, smooth, or sometimes very slightly wrinkled in old individuals, closely adherent to the mantle. *Mantle* bright crimson. *Tentacular filaments* slender. *Branchial sac* red, with one large fold, and a smaller one on the left side, and two or three obscure ones on the right: the largest folds are near the ventral plait, which is smooth. *Ovaries* disposed in small crimson pellets over the inside of the mantle. Height from a quarter to nearly half an inch.

This interesting species was found cast up, after a storm, at Wick, by Mr. C. W. Peach. It differs from most of its congeners in the smoothness of its test and the little prominence of its apertures, which are generally level with the surface when closed. The beautiful group from which the description is taken,

kindly forwarded to me by Mr. Peach, consists of a globular mass of individuals of all ages and sizes, piled upon each other so as to resemble a large fruit of the *Rubus* tribe. The extraneous substance to which they are attached is so completely covered as not to be discernible; and the individuals themselves adhere so closely that, at first sight, they appear to form one compound animal. That this is not the case, however, may be seen by a more minute inspection, when the line of junction between each can generally be detected, and, with a little care, an individual may be detached entire, showing no point of organic junction with the rest. The young fix themselves on all parts of the older ones, and in the spaces between them, so that, in process of time, a globular mass such as here described is the result.

Genus *THYLACIUM*, Victor Carus.

“Common base a broad fleshy structure supporting closely-set individuals; outer tunic coriaceous; both orifices with four lobes; abdomen as long as the thorax.”

Dr. T. Victor Carus thus characterizes a genus established by him in the ‘Proceedings of the Ashmolean Society’ (vol. ii. p. 266) for the reception of an Ascidian found in the Scilly Islands. The connexion of the individuals of this genus by a solid fleshy base has induced the learned author to include it in the family *Clavelinidæ*. It has, however, a much closer affinity with the *Asciadiadæ*, especially with the two small gregarious species of *Cynthia* just described. Dr. Carus considers that this genus is propagated by gemmation as well as by ova. Further observations are desirable on this point.

Thylacium Normani, n. sp.

Body subclavate, rounded above and contracted a little below, reddish, firmly fixed in groups to a common fleshy base. *Aper- tures* rather large and prominent, set considerably apart at the upper end, quadrate, or nearly circular when expanded, sometimes appearing as a single slit when closed. *Test* strongly wrinkled or subtuberculated, rather smoother near the apertures. *Tentacular filaments* linear, very slender. *Branchial sac* with two or three (?) folds on each side. Height about two-tenths of an inch.

Mr. Norman, to whom I am indebted for the knowledge of this species, found it studding the roof and sides of the celebrated Gouliot Caves, Isle of Sark. It is much smaller than the *T. Sylvani* of Carus, of a different form, and appears to spread more horizontally.

Thylacium variegatum, n. sp.?

Body (in each individual) transversely ovate, depressed, doridiform, shaded with flesh-colour and red. *Apertures* not much apart on the upper surface, the branchial rather nearer the end. *Test* slightly wrinkled, or nearly smooth, generally red towards the anterior, and paler towards the opposite end, with a paler raised circle round each aperture, that of the branchial largest, and radiated with red. *Tentacular filaments* linear, stout. *Branchial sac* with folds. The individuals are connected by a membranous expansion at the base, of a paler colour. Length (transverse) of individuals about one-eighth of an inch. Diameter of the general mass one-half to three-quarters of an inch.

One or two specimens of this curious species were kindly sent me by Mr. Jeffreys, along with other Ascidiæ, from Lulworth Cove. I am much inclined to believe that this is the true *Distomus variolosus* of Gærtner, judging from the figures copied in Blainville's 'Manuel de Malacologie,' which greatly resemble our Ascidian, the only material difference being that the apertures are represented six-cleft. On turning to Gærtner's description, quoted in Savigny's 'Mémoire,' p. 38, we find it to agree even more closely with this species. The individuals (*verruca seu tubercula*) are "ovalia et ex croceo rubra," and the apertures are surrounded by a swollen margin with six rays, "quasi in tot discissus fuerit dentes." If we may understand this to apply to the coloured markings, giving the apertures the appearance as if cut into six segments, the description agrees with what is seen in the branchial aperture of the Lulworth-Cove specimens, which have the paler area surrounding it often divided into rays like the leaves of a flower; these rays are frequently six, though the aperture, which is small and inconspicuous when closed, is obscurely quadrate. Should this conjecture prove correct, Gærtner's *Distomus* has been entirely misunderstood by Savigny, as the present species has no relationship with the genus *Distoma* of the latter, founded upon the species he has so well described under the name of *D. rubrum*. Further investigation, however, is necessary; and the suggestion is now thrown out to induce naturalists who may meet with this Ascidian in a living state to examine it more carefully.

The specimens sent by Mr. Jeffreys are parasitical upon the test of *Cynthia mammillaris*, another lost species of Gærtner which has been already alluded to.

I lately received from Mr. George Hodge specimens of a *Thylacium* that may possibly be identical with this, though rather larger and of a deeper red. They were found on the fronds of *Laminaria digitata* cast ashore at the Island of Herm.

Diazona Hebridica, Forbes & Goodsir.

Syntethys Hebridicus, Forbes & Goods. in Trans. Roy. Soc. Edinb. vol. xx. p. 307; Forbes & Hanl. Brit. Moll. vol. iv. p. 244.

That the *Syntethys Hebridicus* of Forbes and Goodsir is really a *Diazona* will be obvious to any one who has the opportunity of carefully investigating its characters, one or two of which appear to have escaped the observation of the distinguished naturalists who first described it. The division of the apertures into six lobes is very difficult to make out, except in well-preserved specimens; and the elongated and pedunculated form of the abdomen is a character varying exceedingly according to the degree of contraction in which the animal is seen. I was so fortunate as to dredge large masses of this remarkable Ascidian at Guernsey in 1853, and had the opportunity of examining it in a living state, when it was at once recognized as the *Syntethys Hebridicus* of Forbes and Goodsir; but on placing specimens in spirits, the apple-green colour of the living animals began to change into a delicate violet, and the whole put on the appearance of *Diazona violacea* of Savigny. This author, whose anatomical details are admirable, has failed to give a good general representation of the animal, from having had access only to spirit specimens. His generic and specific names are in consequence somewhat of misnomers, as the flattening of the surface, from the individuals falling from the centre in dying, gives more of a circular arrangement than really exists in nature.

The change of colour has already been remarked upon. The question arises, therefore, whether *Diazona violacea* and *Syntethys Hebridicus* are not one and the same animal. The only difference I can find is that the papillæ of the branchial sac in the latter are stout and obtuse, very different from the slender, pointed form represented by Savigny; I have therefore determined to consider them distinct until further observations decide the point. Prof. Goodsir has kindly supplied me with a portion of a specimen from the original habitat, and, I believe, coincides in the view of its generic relation here taken. I am also indebted for specimens to Mr. M'Andrew.

Its vitreous transparency and the opaque white lines of the thorax give this remarkable species very much the appearance of a huge group of *Clavelinæ* cemented together at the base.

Polyclinum succineum, n. sp.

Common body subglobose, a little depressed, very transparent, amber-coloured, attached by a broad base, the surface slightly lobated. Individuals disposed over the surface without apparent order, forming numerous systems, each with a prominent funnel-

shaped common excretory orifice, of great transparency. *Branchial apertures* six-rayed. *Thorax* cylindrical, occupying more than one-third of the length of the body. *Abdomen* rounded, simple; *postabdomen* about the same length as the thorax, slightly pedunculated, and ending in a point below. Diameter of the mass about three-quarters of an inch.

This species was dredged by Mr. Norman on the haddock-ground about six miles north of the Whalsey Lighthouse, Shetland. It is remarkable on account of its great delicacy and the transparent funnel-shaped excretory orifices, which rise considerably above the surface.

Polyclinum cerebriforme, n. sp.

Common body transversely ovate, depressed, pretty largely attached, yellowish, the surface corrugated into folds like those of the surface of the brain. *Individuals* irregularly disposed over the surface; systems few; the excretory orifices rather small, circular, with the margin very slightly produced. Longest diameter of the mass three-quarters of an inch; shortest, about half an inch.

This is another of the species for which I am indebted to my friend Mr. Norman, who procured two specimens, between tide-marks, on the south side of Bantry Bay, in October 1858. It is distinguished from *Polyclinum aurantium* by the folds of the surface, as well as by its smaller and more circular common apertures. The character of the individuals could not be satisfactorily made out.

Amaræcium pomum, Sars.

Amaroucium pomum, Sars in *Nyt Magaz. for Naturv.* vol. vii. p. 155.

Common body globose, subcartilaginous, yellowish-grey, sessile, attached by a spreading base. *Individuals* straw-coloured, rather large, set in numerous regular systems of from six to twelve, in single series, round a prominent central orifice with a lobed margin; the lobes corresponding to the number of individuals. *Thorax* yellow, pellucid. *Branchial sac* with ten to eighteen rows of stigmata. *Abdomen* shorter than the thorax, oval; stomach brownish-yellow, areolated: *postabdomen* long, cylindrical, acuminate below. Diameter of mass various. Length of individuals nearly half an inch.

A specimen of this fine species was sent to me by Mr. Macdonald, of Elgin, obtained from deep water in the Moray Firth. It was much smaller than the Norwegian specimens described by Prof. Sars, the mass not measuring more than an inch and a quarter in diameter; but the agreement of its characters in

other respects leaves little doubt of its identity with his species. The size of the mass is always variable, depending upon the age and other circumstances. *Amaræcium pomum* comes very near to the *A. Nordmanni* of Milne-Edwards; but it differs in colour, in the size of the individuals, and in the greater length of the postabdomen.

Amaræcium papillosum, n. sp.

Common body depressed, sessile, yellowish fawn-coloured. *Individuals* prominent, rising into distinct papillæ over the surface, and forming numerous, irregular, close-set, ill-defined systems, set round wide common orifices. *Branchial aperture* with six obtuse lobes. *Thorax* brownish fawn-coloured. *Abdomen* rather darker: *postabdomen* longish, cylindrical. Diameter of mass about an inch; height about one-third as much.

Two specimens of this *Amaræcium* were obtained by dredging in shallow water, Menai Straits, in 1852.

Sidnyum turbinatum, Savigny.

A compound Ascidian sent by Dr. Leach to Savigny, from the English coast, is described under this name by the latter, in a short Appendix to his Mémoire. Two different species have been referred to it by British authors, but, I think, erroneously. Dr. Fleming found what he was "inclined to consider" the *S. turbinatum* on the rocks of the Isle of May. His description in 'British Animals' is compounded of the characters of Savigny's genus combined with those of his own recent specimen. What we consider to be Dr. Fleming's species is not uncommon on the eastern coast. Prof. Edward Forbes, again, has described another species as the *Sidnyum turbinatum* of Savigny, and has altered the generic character to suit it. It is only necessary, however, to pay a little attention to Savigny's description to be convinced that our distinguished English naturalist was under a mistake, and that his species, which is composed of short, cylindrical, truncated masses, nearly as broad below as above, the individuals of which have a branchial aperture of eight rays and a broad postabdomen (see Brit. Moll. pl. B. f. 2), cannot be the animal described by Savigny with a turbinated common body, contracted below, the individuals having a branchial aperture with six rays, and a pedunculated postabdomen, dilated and filiform (*nince comme un fil*); besides which, Forbes's species has a common excretory orifice (mentioned only as a depression in the description), removing it to a different section from Savigny's *Sidnyum*, which, like *Aplidium*, is without this character. Add to which, the individuals of *Sidnyum* are arranged in narrow ellipses radiating from the centre to the circumference,

like the plates of a Madreporæ, while Forbes's species has the individuals arranged circularly round the common centre. Both the species described by British authors belong to the genus (or subgenus*) *Parascidia* of Milne-Edwards, which has been separated from *Amarœcium* on account of having eight lobes to the branchial aperture, none of the other genera of compound Tunicaries having more than six. I propose naming these two species *Parascidia Flemingii* and *P. Forbesii*. The *Sidnyum turbinatum* remains yet to be recognized.

Parascidia flabellata, n. sp.

Common body elongate, lobulated, transparent, consisting below of a very much produced peduncle, which is divided above into several oblong branches, variously lobed, forming a somewhat fan-shaped expansion at the free end; many orange masses or spots in the interior give an orange hue to the whole. *Individuals* elongate. *Branchial apertures* eight-lobed, tinged with orange. *Postabdomen* longish, linear, and rather thin. The whole mass is prettily and minutely speckled with orange.

The above account of a very interesting little *Parascidia* is extracted from the Rev. T. Hincks's manuscript notes of Tunicata obtained in Salcombe Bay in 1848, kindly placed at my disposal. Mr. Hincks met with this species hanging about a *Cellularia* in little orange transparent tufts. There can be no doubt of its distinctness from any species yet described.

Distoma vitreum, Sars.

Distomum vitreum, Sars in *Nyt Mag. for Naturv.* vol. vi. p. 154. Christiania, 1851.

Common body greyish-white, hyaline, subcartilaginous, clavate or fusiform, adhering by a narrow base. *Individuals* white or yellowish, irregularly disposed. *Branchial* and *anal apertures* each with six blunt lobes. *Abdomen* ovate-oblong, united to the thorax by a thickish peduncle; the stomach brownish and longitudinally plicated. Length of mass a quarter to half an inch.

A cluster of specimens of different sizes (mostly young), adhering to the stem of a Zoophyte, was dredged by Mr. Norman in the Channel Islands.

Botrylloides sparsa, n. sp.

Common body rather thick, encrusting, semitransparent, of a yellowish-brown colour. *Individuals* rather small, yellowish-brown, thickly sprinkled with dark brown spots, with a circle of

* Prof. Milne-Edwards makes both *Amarœcium* and *Parascidia* subgenera of *Polyclinum*. I prefer considering them genera.

sulphur-yellow round the branchial orifice, continuous with a stripe or blotch of the same colour above; they are arranged in short, ill-defined, branching systems, with the common orifices indistinct. Diameter of mass two to two and a half inches.

I met with this species on the under side of stones within tide-marks, St. Peter's Port, Guernsey, in 1853. This and the following species have the individuals more minute than is usual in the genus.

Botrylloides pusilla, n. sp.

Common body encrusting, semitransparent, orange-flesh-coloured, with yellow marginal tubes. *Individuals* small, bright orange-scarlet, consisting of a minute sprinkling of scarlet on a yellow ground; there is a yellow spot behind the branchial aperture, and the anal aperture is also yellow; the individuals are set in crowded double or treble rows, forming ill-defined systems. *Branchial sac* with ten rows of stigmata. Diameter of mass nearly two inches. Length of individuals half a line.

A single specimen of this beautiful and very distinct *Botrylloides* was got on the under side of a stone at Grand Havre, Guernsey, in 1853.

Figures of most of the species here described, along with others not previously or hitherto imperfectly figured, will be given in an illustrated Catalogue of British Tunicata, now preparing for the British Museum.

EXPLANATION OF PLATE VII.

Fig. 1. A portion of the branchial sac of *Ascidia parallelogramma*, highly magnified.

Fig. 2. Two spiral coils of the same, more highly magnified.

Fig. 3. A small portion of the branchial sac of *Molgula arenosa*, showing the cones in profile.

Fig. 4. Two of the cones seen in front.

XIX.—On the Composition of the Head, and on the Number of Abdominal Segments, in Insects. By DR. H. SCHAUM.

[Plate VI.]

As the opinion has lately gained much ground among the comparative anatomists of England, chiefly through the embryological researches of Prof. Huxley, that the head of the Arthropoda is made up of a number of segments, I desire to draw attention to some facts which seem to militate against this view. Prof. Huxley* admits, with regard to the greatest number of

* "On the Agamic Reproduction and Morphology of *Aphis*," Trans. Linn. Soc. xxii. p. 229 &c.